TELESCOPE FEED HAMMER DRILLS

INGERSOLL "CROWN" RAND "IMPERIAL"

INGERSOLL-RAND COMPANY
11 BROADWAY, NEW YORK

Form No. 4010 April, 1909

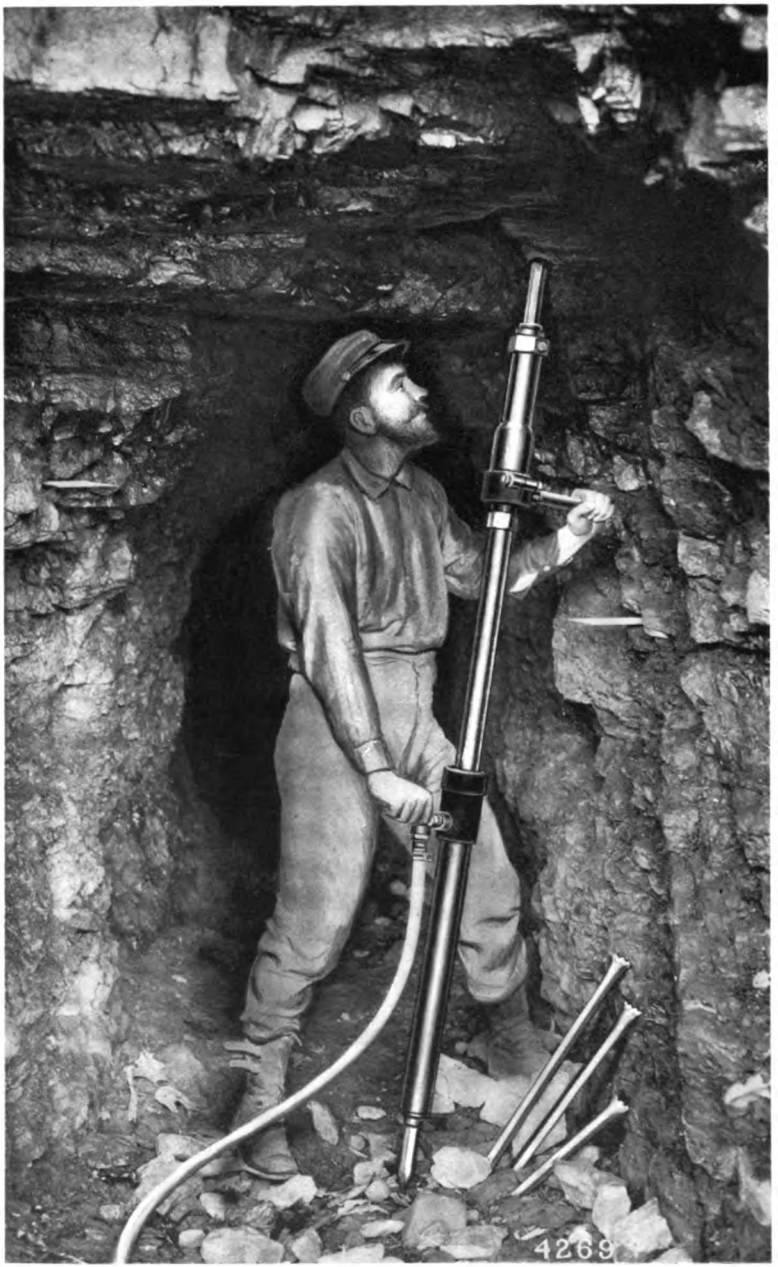
THE term "hammer drill" distinguishes those light machines in which the steel is not attached to and reciprocated with the piston, but is struck by the piston or hammer, as in hand drilling. Such machines are built in two types — the hand tool and the telescope feed tool — both intended for use with no fixed mechanical mounting. There are instances, however, where the latter type is successfully used with such a mounting as a tripod or column.

The Ingersoll-Rand Company now offers a complete line of hammer drills representing the most advanced practice, which may be accepted as thoroughly practical, efficient, and successful machines, fully up to the standard of quality distinguishing the Company's well known line of piston drills. The present pamphlet is devoted only to the telescope feed types, with applications as defined later in these pages.

The Work of the Hammer Drill

The hammer drill is rapidly supplanting hand drilling in every field, purely on the ground of lower cost per foot of hole drilled. The type should not be considered as a substitute for the standard piston rock drill. Its principal application is in the class of work which the larger machine never even attempted to handle, for most of the drilling in many mines is still done by hand.

While it is true that the smaller sizes of piston drills have been and are to-day used in certain classes of stoping work, they have never completely solved the stoping problem in all cases. A large part of this important work has still had to be done by costly hand methods. This may now be done with the hammer drill; and some of the larger sizes in this latter type have in some cases successfully replaced the small piston drill for even the heavier portions of this work. In many mines a change in the method of mining to meet the hammer drill on its best ground will be followed by large savings.



Drilling an upper with the "Imperial MB-12" Hammer Drill; telescope feed extended

Applications of the Hammer Drill

The hammer drill in the quarry is usually of the plain hand tool type and finds its application in drilling plug-and-feather holes, pop holes, block holes, and anchor bolt holes.

In mining practice the prevailing type is the telescope feed hammer with automatic telescope air pressure feed, though the hand tool has also a limited application. Its work here is drilling in upraises, stoping, following narrow, rich veins, squaring up, cutting hitches, trimming walls, and occasional drilling of pop holes and block holes.

In the coal mine the hammer drill is useful in cutting ditches, sumps, etc., levelling floors, taking off rolls or "horse backs," taking down roof, taking up floors, brushing entries, cutting through spars, drilling holes for trolley hangers or engineering points, cutting trolley crossovers, etc.

The work of the hammer drill in contracting replaces "mud capping" and includes block holing, "pop" shooting, drilling anchor bolt holes, breaking up old concrete or masonry foundations, piers, walls, etc., dislodging the substructure of old cable or conduit railways, and removing rock in sewer, gas, water main, or conduit trenches, in cellars, shafts, wells, etc.

The Advantages of the Hammer Drill

The hammer drill is extremely simple, having only one, or at the most two, moving parts. This means a steady reliability and ease of upkeep, with low repair costs in the present Ingersoll-Rand types.

Requiring but a moment to change steels or start a new hole, probably seventy to ninety percent of the work paid for is applied in actual drilling, while with an ordinary piston drill usually not more than two-thirds and often less than one-half the time is actual drilling time. This is a most important point in work where a large number of small, shallow, and carefully placed holes are required.

The great number of light blows of the hammer drill is less destructive of steels than the heavier blows of the piston drill. The loss of gage of the bits is not so rapid. The breaking or dulling of steels for a given footage of holes is much less than in hand drilling and usually not more than half with the hammer drill what it is with the piston drill.

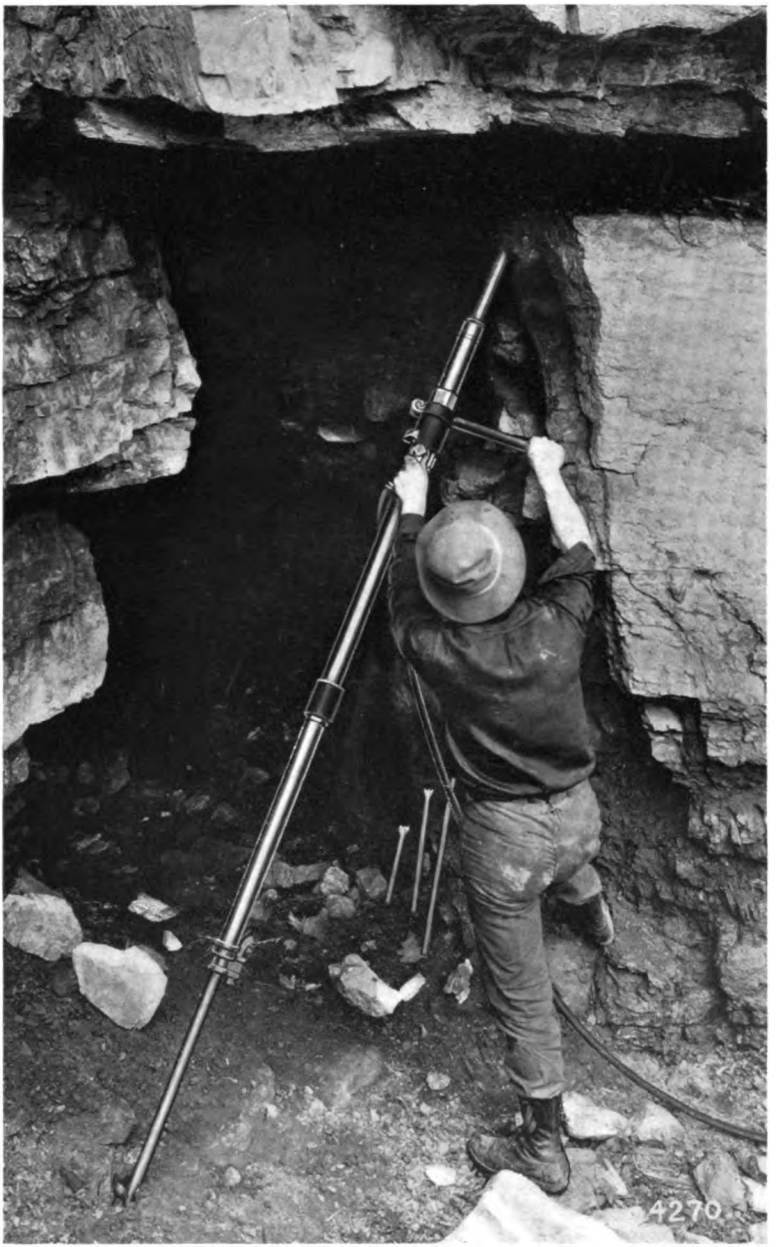
The hammer drill can be used in extremely close quarters — places where no piston drill with a fixed mounting could be used, or even a hand hammer swung. Wherever a man can go he can take a hammer

drill with him. It is truly a "handy" machine, easily carried anywhere under all conditions.

No special skill is required to operate a hammer drill; and herein lies one of its greatest advantages. Only a skilled machine man can overcome a "fitchered" hole, start a difficult hole or determine the proper feed and stroke, thus getting maximum results with a piston drill. But a half day's work will familiarize any intelligent laborer with the hammer drill. One skilled miner can direct or "point" the holes for half a dozen or more hammer drills — a most important item where good men are hard to get.

It is no exaggeration to say that ninety percent of the stoping work in the mines of the world is still being done by hand. It is also a fact that one hammer drill will average an equivalent of six to fifteen hand drillers. Good labor is every year more scarce. If ten hammer drills will do the work of one hundred hand miners, they are certainly a good investment. With a limited force provided with these drills, ten times the drilling can be done and the production correspondingly increased, thus getting cheap machine results in one year which would otherwise take much longer.

The "Crown HB-10" Hammer Drill in operation; standard telescope feed extended and extension pointer run in



The "Crown HC-10" Hammer Drill putting in an upper; telescope feed and extension pointer run out, showing the advantage of this drill in high stopes

The "Imperial MC-22" Hammer Drill with reversed feed mounted on a stoping column

This advantage goes still further. Much of the economy of mining depends on the holes being properly and skilfully placed to bring out the maximum quantity of ore with the minimum powder charge and with the least amount of undesirable waste rock. It is certainly true that the average skill of ten selected hammer drill men will be higher than that of a gang of one hundred hand drillers. The importance of this point in its bearing on low mining costs and improved operating conditions will be appreciated by every mine manager.

The hammer drill enables the miner to follow a vein in a stope only wide enough for his body, bringing out the ore with maximum values and with the minimum of waste rock to be sorted or treated. One instance may be noted. A 2¼-inch piston drill stoping in a 14 to 18-inch vein gave ore values of $30 to $35 per ton. The substitution of a hammer drill brought out one-third more ore from a stope 18 inches wide than the piston drill brought out from a 3½-foot stope; and

Two "Crown HB-10" Hammer Drills in a Tennessee copper mine

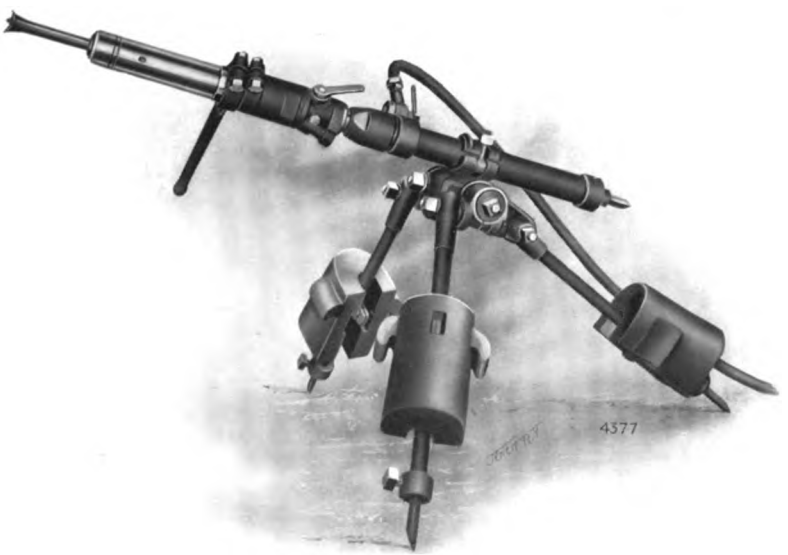
A "Crown HB-10" Hammer Drill in a Nevada gold mine

values at once ran up to $80 or $90 per ton. Hoisting, sorting, and powder costs were cut in two; timbering costs were reduced two-thirds, and the total ore tonnage was increased. Power cost per shift for one drill was reduced from $3 to $1. In this case the user figured that the smaller machine was worth $1,000 per month to him.

Hammer Drill Construction

When an attempt is made to apply ordinary rock drill construction to the lighter hammer drill, failure is sure to result. It is equally true that ordinary pneumatic tool standards or designs do not apply in this case. The many hammer drills which have appeared in the last few years, only to drop from sight after a little actual service, instance the failure of such attempts. While the end to be obtained is the same with both the piston and the hammer drill, the problem must in the case of the latter be approached from an entirely different standpoint and is best met by the largest experience in machine drilling.

The necessity for light weight; the great number of blows per minute; the high velocity of moving parts; the small surfaces exposed to wear; the great depreciation following only a little wear — these are



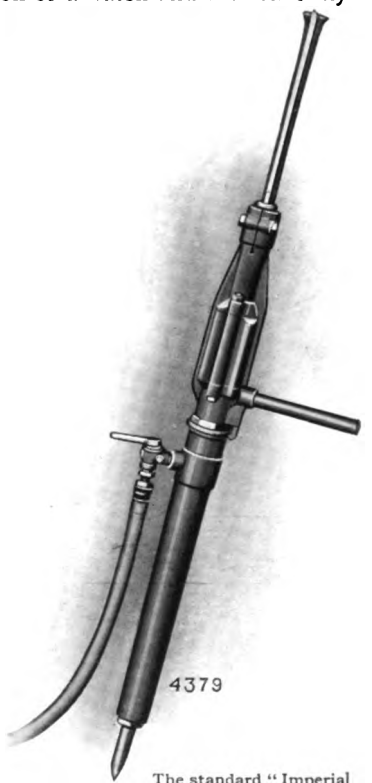
A "Crown HC-12" Hammer Drill with reversed telescope feed, mounted on a standard "A-35" Sergeant tripod with "C" weights

elements which must be provided for in the hammer drill, together with a strength and endurance equal to the most severe rock drill duty.

The rules to be followed in producing the heavier piston drill apply only partially to the manufacture of a light hammer drill. Ingersoll-Rand hammer drills, therefore, while designed in a perfect understanding of drilling requirements, represent a distinct departure from ordinary rock drill practice. Their construction approximates more that of the rapid-fire gun or the perfected high-class rifle. They are superior mechanisms in which every working part is of hardened and ground high-carbon steel, built with the precision of a watch and the reliability of a monkey wrench.

Hammer Drill Economy

Throughout every detail of design and construction of Ingersoll-Rand hammer drills, the ideal of sustained economy and capacity has been sought above all else. A machine which, when new, will drill 10 inches a minute on a claimed consumption of 40 cubic feet of air, and then rapidly drop in a few weeks or months to a rate of 1 to 4 inches on 60 to 90 cubic feet of air, cannot be compared as a successful permanent investment with a drill which, during a long period of reliable service, will put down 6 inches of hole per minute under average conditions, with perhaps less than 50 feet of air. The former figures simply suggest a prevalent condition in the hammer drill situation. The latter represent the ideal embodied in the present Ingersoll-Rand types.



The standard "Imperial MC-22" Telescope Feed Hammer Drill

Telescope Feed Hammer Drills

This pamphlet is devoted exclusively to Ingersoll-Rand Telescope Feed Hammer Drills, in Ingersoll "Crown" valve, and Rand "Im-

perial" valveless, models, in various sizes and types adapted for varying operating conditions.

The other type of hammer drill, in distinction to the telescope feed drill, is that which is held in the hand like a pneumatic tool. Such drills are used for shallow holes in mines and quarries, or in heavier types for deep down holes, as in sinking. They will be described in a separate pamphlet.

The telescope feed hammer drill, when used without a water or an air jet, is suitable only for holes above the horizontal because of the tendency of the cuttings to pack around the bit where holes run below the horizontal. For up hole service in dry rock the cuttings free themselves by dropping out of the hole, hence the steels furnished for these machines and listed on pages 26 to 28 are solid steels in either hexagon or cruciform section, as ordered.

For 'up' holes in damp, sticky ground where the cuttings will not run out by gravity, these drills can be specially furnished, on order, with a hollow anvil block for the use of hollow drill steels with an air jet through the steel for blowing out the cuttings. Prices on hollow drill steels will be furnished on application.

In down hole service the regular rock drill is the best. So far no hammer drill has equalled it, for the reciprocating movement of the piston drill clears the hole and gives the maximum cutting speed.

The Ingersoll-Rand Line

The Company's present advanced line of hammer drills includes two distinct series, differing radically in fundamental design, but alike in the care bestowed upon every detail of construction and materials.

The "H" series of Ingersoll "Crown" VALVE tools has a valve movement entirely separate from the piston or hammer movement, the valve being of an "air-thrown" type moved by differences of air pressure on the faces of the valve. This valve action is positive, reliable, and of remarkable simplicity.

The "M" series of Rand "Imperial" VALVELESS tools has the admission and exhaust of air controlled by the movement of the piston itself, the latter covering or uncovering various air ports in its travel. There is thus but one moving part to the machine.

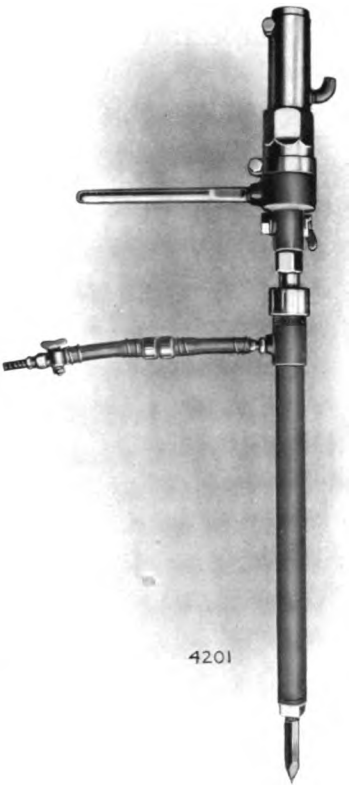
Valve Tools *vs.* Valveless Tools

The Company's experience enables it to draw with reasonable clearness the line of distinction between the proper field for the "valve" hammer drill and the "valveless" tool.

IN MOST HARD ROCKS AND WHERE LOW OR MEDIUM AIR PRESSURES ARE USED, THE VALVE TOOL, AS REPRESENTED BY THE "H" SERIES OF INGERSOLL "CROWN" HAMMER DRILLS, WILL PROBABLY GIVE THE BEST RESULTS AND IS USUALLY TO BE PREFERRED UNDER SUCH CONDITIONS.

IN SOFT OR MEDIUM ROCKS AND WHERE THE AIR PRESSURE IS HIGH, EXPERIENCE SEEMS TO SHOW THAT THE VALVELESS TOOL OF THE "M" SERIES OF RAND "IMPERIAL" HAMMER DRILLS WILL PROVE THE MORE RAPID DRILLER.

The explanation is as follows: The valve tool has a longer stroke, strikes a harder, sharper blow, and fewer blows per minute, while the valveless tool strikes a greater number of short-stroke, lighter blows. This results in a marked difference in the quality of the blow of the two drills. In hard rock the valveless tool has a tendency to pulverize rather than chip away the rock, giving relatively less penetration and tending toward the production of a larger amount of dust. The valve tool, on the contrary, appears to break away the rock in larger chips, giving less dust and cutting more rapidly. In soft rock the valve tool, with its powerful, swinging blow, appears to drive the bit into the rock without chipping, making the rotation difficult; while the valveless tool with its lighter, more rapid blow, cuts freely into chips rather than powder, cleans well with the minimum amount of dust, rotates easily, and penetrates rapidly.



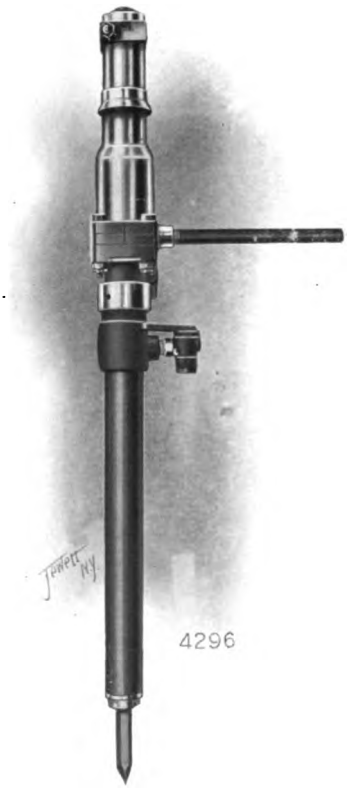
The standard type of the "Imperial MA-12" Telescope Feed Hammer Drill

It is, of course, to be understood that these are general conclusions only. It is impossible to state any hard-and-fast rule governing the application of these two types of drills, as in the final analysis the peculiar characteristics of the rock to be drilled must determine which of the

two will give the better result. The development of these two distinct types of hammer drills for seemingly similar work is simply in line with the Company's policy of examining every problem in minutest detail, with a view to furnishing the best machine for the work in hand. The Company has no interest in pushing a valve tool as against a valveless tool, or vice versa, except in so far as the customer's interest is furthered by using the drill which is the best one for his particular drilling conditions.

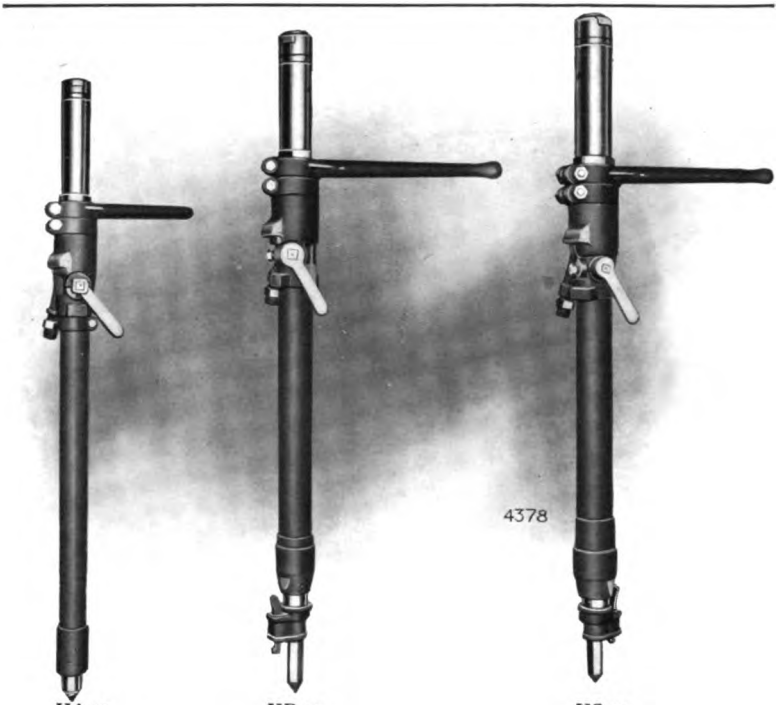
Some Important Details

In both the "H" and the "M" series all wearing parts of the drill proper are given special treatment to eliminate wear and consequent leakage. The cylinders of steel are hardened and ground in the bore. The hammers or pistons are of hardened and ground steel. In the "H" drills the valve and valve box are of hardened and ground steel. All styles use plain, solid, "shankless" steel, a hardened steel anvil block being interposed between the hammer and the butt of the steel. Chuck bushings are furnished to accommodate either hexagon or cruciform steel and orders should state which of the two cross-sections of steel is to be used, as well as the size of the steel. A small sample of the steel which it is proposed to use, if sent with the order, will be of assistance in furnishing a suitable chuck bushing, as there are several different styles of steel on the market. Some sample sections are shown on page 17.



Standard "Imperial MC-12" Hammer Drill

INGERSOLL-RAND TELESCOPE FEED HAMMER DRILLS LISTED IN THIS PAMPHLET ARE INTENDED



HA-11 **Light Drill** HB-10 **Medium Drill** HC-10 **Heavy Drill**

The three sizes of the "Crown" Hammer Drills in relative proportions

FOR UP HOLES AT ANY ANGLE GREATER THAN TWENTY DEGREES ABOVE HORIZONTAL.

The telescope extension pointer furnished on certain types is simply an auxiliary tube terminating in a steel pointer which slides inside the feed piston and is held in any position by a wedge lock fastened or released by a hammer blow. It is used to lengthen the drill when necessary for a proper set-up. A device is provided on all drills which prevents the running out of the telescope feed when the drill is being carried from place to place.

Rotation is provided in all types by handles screwed or clamped to the back head of the drill. Special care has been exercised to provide free lubrication for every working part, this feature being of vital importance in its bearing upon the life and efficiency of the machine.

Types, Sizes, and Symbols

As already stated, the "H" series of Ingersoll "Crown" tools includes all valve hammer drills and the "M" series of Rand "Imperial"

tools all valveless drills. These letters, in combination with other letters and figures, as explained below, form the symbols designating the several modifications of the basic type.

The letter "A" stands for the light drill in both series, "B" for the medium drill, and "C" for the heavy drill.

The figure "1" immediately following the letter indicating the size of the drill is the serial indicating the number of the type offered. As the type is changed this figure will be changed, running up to "9" in the order of the changes. The present types, with one exception, all have the number "1."

The figure "0" immediately following the type serial number stands for the standard telescope feed with feed cylinder attached to the drill proper and with the feed piston running out, the extension pointer being used. The figure "1" after the type number indicates the same telescope feed as the figure "0," but with the extension pointer omitted. The figure "2" following the type number designates a reversed telescope feed; i.e., the feed piston is attached to the drill with the feed cylinder, carrying the pointer, running out. No extension pointer is used in this drill, which is adapted for use with a mechanical mounting — column or tripod.

The complete symbols of the several combinations now offered to the trade thus become as follows:

Ingersoll "Crown" Valve Drills — Symbol "H"

Light Drills — Symbol "A"

Standard Telescope Feed, without Extension . .	HA–11

Medium Tools — Symbol "B"

Standard Telescope Feed, with Extension . . .	HB–10
Standard Telescope Feed, without Extension .	HB–11
Reversed Telescope Feed, for Mounting . . .	HB–12

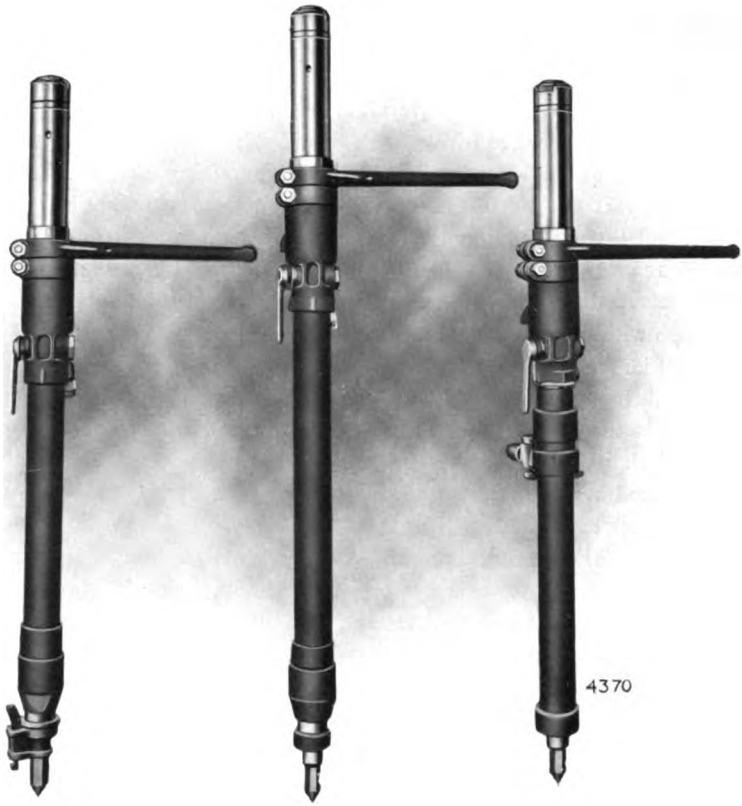
Heavy Tools — Symbol "C"

Standard Telescope Feed, with Extension . .	HC–10
Standard Telescope Feed, without Extension .	HC–11
Reversed Telescope Feed, for Mounting . . .	HC–12

Rand "Imperial" Valveless Drills — Symbol "M"

Light Tools — Symbol "A"

Reversed Telescope Feed, for Mounting . . .	MA–12



"10" Type
Standard Telescope Feed
With Extension Pointer

"11" Type
Standard Telescope Feed
Without Extension Pointer

"12" Type
Reversed Telescope Feed
Without Extension Pointer

The three styles of Telescope Feed furnished on "Crown" Hammer Drills

Medium Tools — Symbol "B"

Reversed Telescope Feed, for Mounting . . . MB–12

Heavy Tools — Symbol "C"

Reversed Telescope Feed, for Mounting . . . MC–12

Reversed Telescope Feed, for Mounting . . . MC–22

It will be noted from the above that the "M" series is furnished only with what is called the reversed telescope feed and is not supplied with the telescope extension pointer. It will be noted, moreover, that the telescope extension pointer is omitted in the light valve drill, as the diameter of the telescope feed is small. The specifications of these several hammer drills are tabulated on page 21.

The Question of Size and Type of Drill

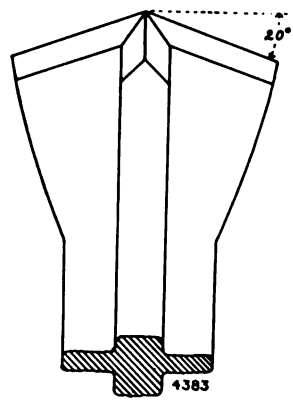
The question naturally arises at this point as to the proper field of application for these several sizes and types of telescope feed hammer drills. The drills with standard feed and no extension (Symbol "11") will serve under average mining conditions, where the stope is not too high. Drills with a telescope extension pointer (Symbol "10") are intended for work in high stopes, or where, for other reasons, a longer drill than the standard feed affords is desirable. The reversed feed drill (Symbol "12" and "22") is intended primarily for use with mechanical mountings; but as it carries a pointer on the end of its feed cylinder it may be used wherever the "11" series can be used, being preferred by some customers.

As to the size of the drill to be used, the following distinctions may be noted. Under ordinary mining conditions, where each miner has a specified average number of holes to drill in a shift, the medium sized tool, either in the "HB" or the "MB" series, will do all the work necessary. For less exacting work, or work of a lighter character than ordinary stoping in average ore, such as breaking up ore in the chutes, the light tool in either the "HA" or "MA" series will give satisfactory results. But where an unusually large number of holes are to be drilled in a limited time, or where the conditions otherwise demand exceptionally rapid work, the heavy tools in the "HC" or "MC" series should be used.

THE COMPANY GUARANTEES FOR THE "CROWN HC" AND "IMPERIAL MC" TOOLS A LARGER DRILLING CAPACITY THAN ANY OTHER TELESCOPE FEED HAMMER DRILLS ON THE MARKET.

Size and Style of Bit

Experience has demonstrated that in hammer drill work a bit with a high center gives the best result; and the steels listed on pages 26 to 28 are furnished with the bit "crowned" about twenty degrees, as indicated in the sketch. Such bits have a tendency to drill a straighter hole, as the high center naturally seeks the center of the hole while a flat bit may work off to one side. Rotation also is found to be easier with "crowned" bits.



A "crowned" hammer drill steel bit

The Company recommends the use of large bits and heavy steels, as giving more satisfactory drilling results and better breaking of the ground. A hole bottomed to take 1¼-inch powder will evidently break more rock than one bottomed for 1-inch powder. Probably five or six holes bottomed for the larger powder will break as much ore as eight or nine holes bottomed for only 1-inch powder. This means less proportionate drilling time for a given amount of breaking, with greater headway made. Rotation is also made easier where a large bit is used.

This general statement, while true so far as large stopes and large raises are concerned, must be qualified where narrow veins are to be followed or where the ground is such that heavy charges would pulverize the ore or shatter the walls. In the latter case smaller holes will serve and a smaller steel and bit may be used.

These facts have a bearing upon the choice of the proper size of drill for a given work. Where large holes and heavy breaking are wanted, the "C" size Ingersoll-Rand hammer drill, using 1⅛-inch hexagon, or 1⅛ or 1¼-inch cruciform steels, should be used. Where smaller holes will give the requisite results, the "B" or "A" size will be the proper one to select.

Cross-Sections of Steel

As already stated, Ingersoll-Rand hammer drills can be furnished for either hexagon or cruciform steels. There are, however, several

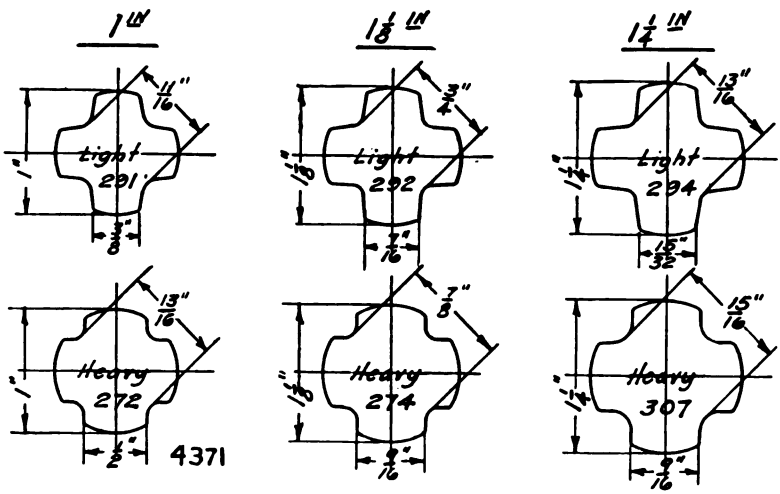
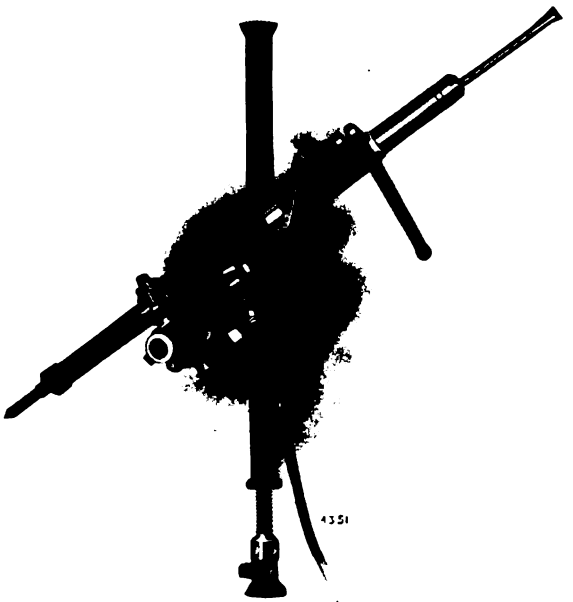


Diagram showing relative cross-sections of "light" and "heavy" cruciform steels in three standard sizes

styles of cruciform steel, some of which are found to predominate in different sections of the country. The diagrams on page 17 show the distinction between these various styles, and in ordering drills the section number given in these diagrams, indicating the steel which is to be used, should be distinctly stated.



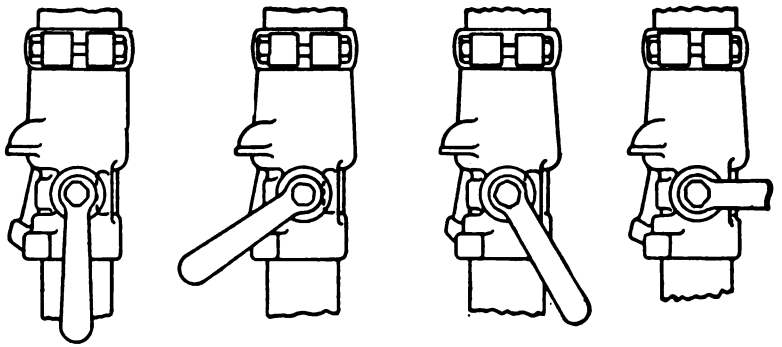
A "Crown HC-12" Hammer Drill with reversed telescope feed on single screw column mounting

Equipment

Each telescope feed hammer drill outfit is understood to include a complete drill with telescope feed, together with such fittings as may properly go with the machine in the way of valves, handles, hose connections, the necessary wrenches, etc. Hose, mounting and steels, however, are not included as a part of the regular machine outfit.

Sizes, Weights, etc.

The table on page 21 lists all the essential information about Ingersoll-Rand telescope feed hammer drills in both the "Imperial M" and the "Crown H" series and in the several types now offered.



1 2 3 4

Positions of throttle valve on "HA-11," "HB-10," "HB-11," "HC-10," and "HC-11" "Crown" Hammer Drills

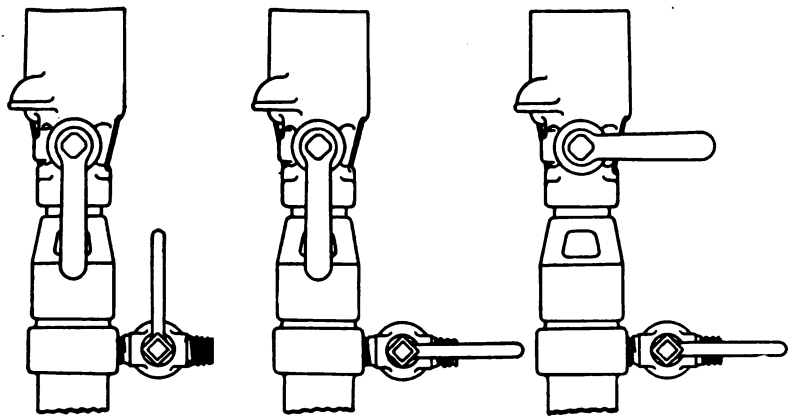
No. 1. In this position the throttle is entirely closed, air being shut off from feed and drill. The oiler is open. Oil cannot be fed to the drill with throttle in any other position

No. 2. This is the position for starting or collaring a hole. Air enters through the telescope feed to the drill, giving moderate feed pressure and drilling speed. THIS IS NOT THE FULL RUNNING POSITION

No. 3. In this position full pressure is on the feed, but the drill is not running; used in "pointing" a hole

No. 4. Full running position; maximum pressure on feed and full drilling speed

Note. — Intermediate positions will give intermediate speeds and pressures



1 2 3

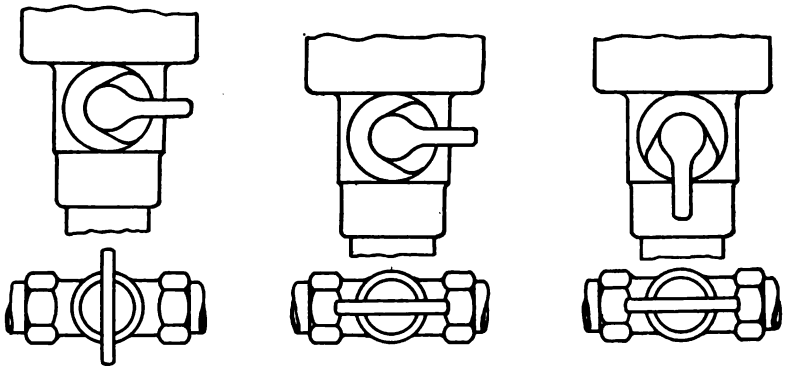
Positions of throttle valves on "HB-12" and "HC-12" "Crown" Hammer Drills

No. 1. In this position both feed and drill throttles are closed, air being entirely shut off from drill. The oiler is open. Oil cannot be fed to the drill with throttle in any other position

No. 2. Feed throttle open, drill throttle closed; full pressure is on feed but drill is not running. This position is used in "pointing" a hole

No. 3. Feed throttle and drill throttle full open, with full feed pressure and full drilling speed

Note. — Intermediate positions will give intermediate speeds and pressures



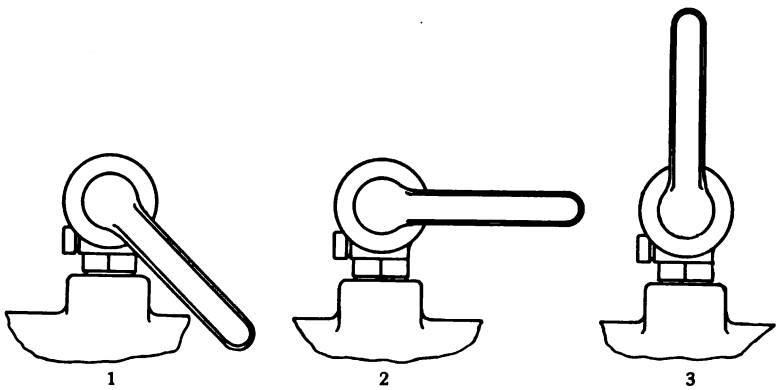
Positions of throttle valves on "Imperial MA-12" Hammer Drills

No. 1. In this position both feed and drill throttles are closed, air being shut off from the machine

No. 2. This is the position for "pointing" a hole, full pressure being admitted to the feed, but the drill not running

No. 3. Full running position, giving full feed pressure and full drilling speed

Note. — Intermediate positions will give intermediate speeds and pressures



Positions of throttle valve on "Imperial MB-12," "MC-12," and "MC-22" Hammer Drills

No. 1. Closed position, the air being shut off from feed and drill

No. 2. Middle position for starting a hole, with moderate feed pressure and moderate drilling speed

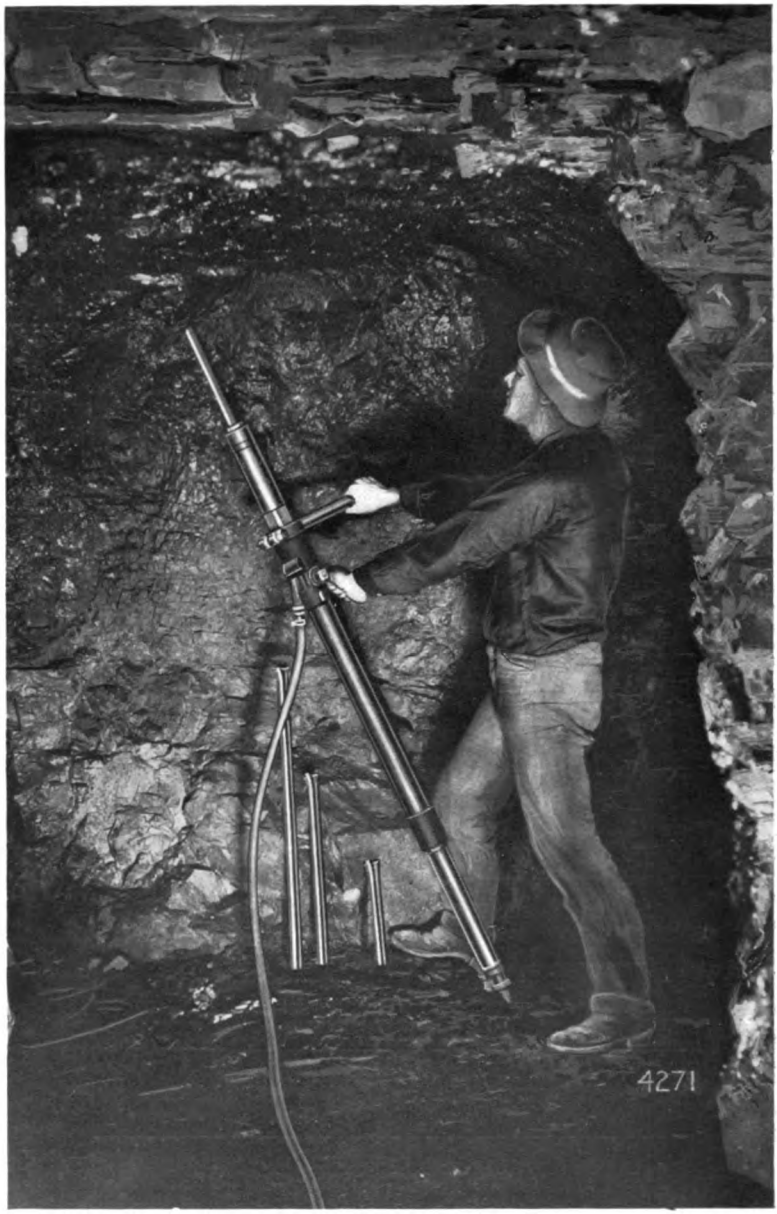
No. 3 Full running position, with full feed pressure and maximum drilling speed

Note. — Intermediate positions will give intermediate speeds and pressures

DESCRIPTIVE TABLE OF INGERSOLL-RAND TELESCOPE FEED HAMMER DRILLS

SPECIFICATIONS	"Imperial" Valveless Drills, Series "M"				"Crown" Valve Drills, Series "H"						
	Light	Medium	Heavy		Light	Medium			Heavy		
Symbol of Drill	**MA-12**	**MB-12**	**MC-12**	**MC-22**	**HA-11**	**HB-10**	**HB-11**	**HB-12**	**HC-10**	**HC-11**	**HC-12**
Diameter of Piston or Hammer, Inches	1 7/16 & 1 11/16	1 3/4 & 2 1/16	1 5/8 & 2 7/16	1 5/8 & 2 1/2	1 3/4 & 2 3/8	1 5/8	1 5/8	1 5/8	2	2	2
Stroke of Piston, Inches	2 1/4	2 1/2	3	4	3 1/2	3 1/2	3 1/2	3 1/2	4	4	4
Weight of Piston, Ounces	42	49 1/2	64	46	26	43	43	43	83	83	83
Length of Drill — Feed and Extension RUN IN, Inches	*48 1/4	*50	*50	*50	*50	*51 1/4	*57	*52	*53 1/2	*59	*54
Length of Drill — Feed RUN OUT and Extension RUN IN, In.	*68 3/4	*70	*70	*70	*74	*69 1/4	*81	*70	*71 1/2	*83	*72
Length of Drill — Feed and Extension RUN OUT, Inches	*	*	*	*	*	*90 1/2	*	*	*92 1/2	*	*
Travel of Telescope Feed, Inches	20	20	20	20	24	18	24	18	18	24	18
Travel of Extension Pointer, Inches	*	*	*	*	*	21	*	*	21	*	*
Number of Blows Struck by Piston per Min., Air at 60 lbs. pres.	1320	1020	990	990	1200	1150	1150	1150	1050	1050	1050
Number of Blows Struck by Piston per Min., Air at 100 lbs. pres.	1560	1270	1120	1120	1400	1350	1350	1350	1300	1300	1300
Free Air Consumption, at 40 Lbs. Pressure, Cubic Feet per Min.		Not adapted for this pressure			12	25	25	25	30	30	30
" " " " 50 " " " " " "		Not adapted for this pressure			18	30	30	30	35	35	35
" " " " 60 " " " " " "	12	24	34	34	22	35	35	35	39	39	39
" " " " 70 " " " " " "	15	30	39	39	26	41	41	41	45	45	45
" " " " 80 " " " " " "	19	35	44	44	30	45	45	45	51	51	51
" " " " 90 " " " " " "	23	44	50	50	35	49	49	49	56	56	56
" " " " 100 " " " " " "	27	48	57	57	40	55	55	55	60	60	60
Size of Air Supply Hose Used, Inches	1	1	1	1	1	1	1	1	1	1	1
‡Size of Hexagon Steel Used, Inches	7/8 or 1	7/8 or 1	1 or 1 1/8	1 or 1 1/8	7/8 or 1	7/8 or 1	7/8 or 1	7/8 or 1	1 or 1 1/8	1 or 1 1/8	1 or 1 1/8
‡Size of Cruciform Steel Used, Inches	1	1 or 1 1/8	1 1/8 or 1 1/4	1 1/8 or 1 1/4	1	1 or 1 1/8	1 or 1 1/8	1 or 1 1/8	1 1/8 or 1 1/4	1 1/8 or 1 1/4	1 1/8 or 1 1/4
BARE OR UNBOXED WEIGHTS, LBS. (Approximate)											
Drill Alone	**42**	**52**	**65**	**65**	**40**	**60**	**65**	**60**	**75**	**80**	**75**
6-Ft. S. S. Col. with Arm, Collar, Clamp and Feed Clamp	**	140	140	140	**	**	**	140	**	**	140
6-Ft. S. S. Col without Arm, with Collar, Clamp and Feed Clamp	**	105	105	105	**	**	**	105	**	**	105
One 50-Foot Length of Plain Air Supply Hose, with Fittings	17	29	29	29	17	29	29	29	29	29	29
BOXED OR SHIPPING WEIGHTS, LBS. (Approximate)											
Drill and Equipment (for equipment see page 17)	**75**	**85**	**98**	**98**	**80**	**100**	**110**	**100**	**120**	**130**	**120**
6-Ft. S. S. Col. with Arm, Collar, Clamp and Feed Clamp	**	190	190	190	**	**	**	190	**	**	190
6-Ft. S. S. Col. without Arm, with Collar, Clamp and Feed Clamp	**	145	145	145	**	**	**	145	**	**	145
One 50-Foot Length of Plain Air Supply Hose, with Fittings	37	50	50	50	37	50	50	50	50	50	50
PRICES (F.O.B. Factory or N. Y.) & TELEGRAPH NAMES	Vainnedad	Vainnedalo	Vainneddo	Vainnedero	Vadabagulo	Vadabahias	Vadabahira	Vadabahuba	Vadabaigne	Vadabaimar	Vadabaires
Drill and Equipment (for equipment see page 17)	**$100**	**$135**	**$135**	**$135**	**$100**	**$135**	**$135**	**$135**	**$135**	**$135**	**$135**
Six-Foot Single Screw Column, with Arm, Safety Collar, Clamp and Feed Clamp, only		Vainnedans **$52**	Vainnedeis **$52**	Vainnedha **$52**				Vadabaico **$52**			Vadabais **$52**
Six-Foot Single Screw Column, without Arm, but with Safety Collar, Clamp and Feed Clamp, only		Vainnedare **$42**	Vainnedent **$42**	Vainnedian **$42**				Vadabaida **$42**			Vadabaison **$42**

* Not furnished with Extension Pointer. ** Not adapted for use with Mounting. ‡ Orders must state size and style of steel to be used (see pages 26, 27 & 28)



A "Crown HB-10" Hammer drill in a mine stope

Blacksmith Tools

The special set of blacksmith tools here illustrated is furnished for the proper sharpening of the hammer drill steels listed on pages 26 to 28. These tools fit any anvil and their use is readily mastered by the average blacksmith. One set as listed below will sharpen the steels for from one to ten hammer drills. As sent out, these tools are not hardened and should be given proper treatment before using.

Standard blacksmith tools for sharpening hammer drill steels

Shop Number	Name	Telegraph Name	List Price
102	Dolly	Vogeledeis	$2.50
103	Sow	Vogeledent	2.50
104	Spreader	Vogeledero	1.50
105	Flatter	Vogeledha	1.25
106	Swage	Vogeledian	1.25
Weight of Set			16½ lbs.
Telegraph Name of Set			Vogeleffo
Price of Set			**$9.00**

Air Supply Hose

The air supply hose furnished for Ingersoll-Rand Telescope Feed Hammer Drills is of a special brand known as "Antipeel," containing a seamless inside tube or lining that will not peel or flake off. This inner tube is covered with seven layers or plies of linen, making a strong covering and a less bulky hose than that made up with duck. This can be furnished in either the plain or wire-wound pattern, the latter being wound with a half-round steel wire with the flat next the hose. Prices, weights, etc., are given below, these including the necessary fittings at both ends of the 50-foot length.

Plain "Antipeel" air hose for hammer drills

Wire-wound "Antipeel" air hose for hammer drills

Name	Weight, Lbs.		Telegraph Name	List Price	List Price Per Foot
	Unboxed	Boxed			
50-foot Length Plain ½-inch 7-ply "Antipeel" Hose, with Couplings	17	37	Volemiora	11.75	$0.20
50-foot Length Wire-wound ½-inch 7-ply "Antipeel" Hose, with Couplings	26	46	Volemiores	12.75	0.22
50-foot Length Plain ¾-inch 7-ply "Antipeel" Hose, with Couplings	29	50	Volemiosae	14.00	0.24
50-foot Length Wire-wound ¾-inch 7-ply "Antipeel" Hose, with Couplings	39	60	Volemiosca	15.00	0.26

Stoping with an "Imperial MB-12" Hammer Drill

HEXAGON HAMMER DRILL STEELS

All the steels here listed are SOLID steels, for UP holes only, with 4-POINT CROSS bits and WITHOUT SHANK AND COLLAR

Drilling Length Excl. of Length in Chuck, Inches	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE Per Single Steel	LIST PRICE Per Set	Telegraph Name of Set	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE Per Single Steel	LIST PRICE Per Set	Telegraph Name of Set	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE Per Single Steel	LIST PRICE Per Set	Telegraph Name of Set
Standard 6-in. Run	⅞-Inch Hexagon				HA or MA HB or MB	1-Inch Hexagon				HB or MB HC or MC	1⅛-Inch Hexagon				HC or MC
6	1 3/4	21 1/4	$1.20		Volemibeis	2	3	$1.30		Volemichir	2 1/8	3 7/8	$1.35		Volemidens
12	1 11/16	3 3/8	1.30	$2 50	Volemibias	1 15/16	4 3/8	1.45	$2.75	Volemichla	2 1/16	5 1/2	1.55	$2.90	Volemideon
18	1 5/8	4 1/2	1.40	3.90	Volemibida	1 7/8	5 7/8	1.60	4.35	Volemicho	2	7 1/8	1.75	4.65	Volemidez
24	1 9/16	5 5/8	1.50	5 40	Volemiblo	1 13/16	7 3/8	1.75	6.10	Volemicide	1 15/16	9 1/8	1.90	6.55	Volemidia
30	1 1/2	6 3/4	1.60	7.00	Volemibrar	1 3/4	8 7/8	1.90	8.00	Volemiciem	1 7/8	11 1/4	2.05	8.60	Volemidito
36	1 7/16	7 7/8	1.70	8.70	Volemibuca	1 11/16	10 1/4	2.05	10.05	Volemicino	1 13/16	13	2.20	10.80	Volemidium
42	1 3/8	9	1.80	10.50	Volemibum	1 5/8	11 3/4	2.20	12.25	Volemicis	1 3/4	15	2.35	13.15	Volemidoir
48	1 5/16	10 1/4	1.90	12.40	Volemibuor	1 9/16	13 1/2	2.35	14 60	Volemicita	1 11/16	16 3/4	2.50	15.65	Volemidojo
54	1 1/4	11 1/2	2.00	14 40	Volemicabo	1 1/2	14 3/4	2.45	17.05	Volemicoba	1 5/8	18 1/2	2.65	18.30	Volemidore
60	1 3/16	12 3/4	2.10	16.50	Volemicada	1 7/16	16 1/8	2.55	19.60	Volemicolo	1 9/16	20 1/2	2.80	21.10	Volemidosa
Special 6-in. Run															
66	1 1/8	13 1/2	2.20	18.70	Volemicant	1 3/8	17 3/8	2.65	22.25	Volemicone	1 1/2	22 3/8	2.95	24.05	Volemidou
72	1 1/16	14 3/8	2.30	21.00	Volemicar	1 5/16	19 1/8	2.75	25.00	Volemictam	1 7/16	24 1/4	3.10	27.15	Volemidrem
Standard 12-in. Run															
12	1 11/16	3 3/8	1.30		Volemicavi	1 15/16	4 3/8	1.45		Volemicule	2 1/16	5 1/2	1.55		Volemidulo
24	1 9/16	5 5/8	1.50	2.80	Volemiccio	1 13/16	7 3/8	1.75	3.20	Volemidaco	1 15/16	9 1/8	1.90	3.45	Volemidura
36	1 7/16	7 7/8	1.70	4 50	Volemiceas	1 11/16	10 1/4	2.05	5.25	Volemidade	1 13/16	13	2.20	5.65	Volemiegio
48	1 5/16	10 1/4	1.90	6.40	Volemicela	1 9/16	13 1/2	2.35	7.60	Volemidais	1 11/16	16 3/4	2.50	8.15	Volemiella
60	1 3/16	12 3/4	2.10	8.50	Volemicero	1 7/16	16 1/8	2.55	10.15	Volemidam	1 9/16	20 1/2	2.80	10.95	Volemien
Special 12-in. Run															
72	1 1/16	14 3/8	2.30	10.80	Volemicet	1 5/16	19 1/8	2.75	12.90	Volemidava	1 7/16	24 1/4	3.10	14.05	Volemience

LIGHT CRUCIFORM HAMMER DRILL STEELS

All the steels here listed are SOLID steels, for UP holes only, with 4-POINT CROSS bits and WITHOUT SHANK AND COLLAR

Drilling Length, Excl. of Length in Chuck, Inches	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE		Telegraph Name of Set
			Per Single Steel	Per Set	
Standard 6-in Run	**Light 1-Inch Cruciform** HA or MA / HB or MB				Section 291 See Page 17
6	1 3/4	2 3/4	$0.90		Volemianos
12	1 1/8	3 1/2	1.00	$1.90	Volemiardo
18	1 1/8	4 1/2	1.10	3.00	Volemiarea
24	1 1/8	5 1/2	1.20	4.20	Volemiasse
30	1 1/8	7	1.30	5 50	Volemiasti
36	1 1/8	8	1.40	6.90	Volemiate
42	1 3/4	9 1/4	1.50	8.40	Volemiatim
48	1 1/8	10 3/8	1.60	10.00	Volemiatur
54	1 1/4	11 1/2	1.70	11.70	Volemiavam
60	1 1/8	12 3/4	1.80	13.50	Volemibala
Special 6-in Run					
66	1 1/4	13 7/8	1.90	15.40	Volemibans
72	1 1/8	15	2.00	17.40	Volemibebo
Standard 12-in. Run					
12	1 1/8	3 1/4	1.00		Volemetoar
24	1 1/8	5 1/4	1.20	2.20	Volemetrae
36	1 1/8	8	1.40	3.60	Volemetrez
48	1 1/8	10 3/4	1.60	5.20	Volemetric
60	1 1/8	12 1/4	1.80	7.00	Volemettir
Special 12-in. Run					
72	1 1/8	15	2.00	9.00	Volemeumia

Drilling Length, Excl. of Length in Chuck, Inches	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE		Telegraph Name of Set
			Per Single Steel	Per Set	
	Light 1 1/8-Inch Cruciform HB or MB / HC or MC				Section 292 See Page 17
2	2 3/4	$1.00		Volemiendo
1 15/16	4 1/4	1.15	$2.15	Volemieras
1 7/8	5 1/4	1.30	3.45	Volemierez
1 13/16	6 1/4	1.45	4.90	Volemieron
1 3/4	8 1/4	1.60	6.50	Volemierro
1 5/8	9 3/4	1.75	8.25	Volemiesco
1 3/4	11	1.90	10.15	Volemiese
1 1/16	12 3/4	2.00	12.15	Volemietta
1 1/4	13 3/4	2.10	14.25	Volemieux
1 1/16	15 1/2	2.20	16.45	Volemifado
1 3/4	16 1/4	2.30	18.75	Volemifera
1 1/16	17 1/4	2.40	21.15	Volemiffas
1 15/16	4 1/4	1.15		Volemiffez
1 13/16	6 1/4	1.45	2.60	Volemifiat
1 11/16	9 1/4	1.75	4.35	Volemifico
1 1/16	12 3/4	2.00	6 35	Volemifier
1 1/16	15 1/4	2.20	8 55	Volemiform
1 1/16	17 1/4	2.40	10.95	Volemifugo

Drilling Length, Excl. of Length in Chuck, Inches	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE		Telegraph Name of Set
			Per Single Steel	Per Set	
	Light 1 1/4-Inch Cruciform HC or MC				Section 294 See Page 17
2 1/4	3 3/4	$1 05		Volemigari
2 1/16	5 1/4	1.25	$2.30	Volemigato
2	6 3/4	1.45	3.75	Volemigena
1 15/16	8 1/4	1.60	5.35	Volemigeos
1 1/4	10 1/4	1.75	7.10	Volemigeur
1 13/16	12	1.90	9.00	Volemigido
1 3/4	13 3/4	2 05	11 05	Volemigiez
1 1/16	15 1/2	2.20	13.25	Volemigior
1 1/16	17 1/2	2.35	15.60	Volemiglio
1 1/16	18 3/4	2.50	18.10	Volemignas
1 1/4	20 1/2	2 65	20.75	Volemignia
1 1/16	22 1/4	2.80	23.55	Volemigon
1 15/16	5 1/4	1.25		Volemigram
1 15/16	8 1/4	1.60	2.85	Volemiguad
1 13/16	12	1.90	4.75	Volemigunt
1 1/16	15 1/4	2.20	6.95	Volemijas
1 1/16	18 3/4	2.50	9.45	Volemijem
1 7/16	22 1/4	2.80	12.25	Volemilano

HEAVY CRUCIFORM HAMMER DRILL STEELS

All the steels here listed are SOLID steels, for UP holes only, with 4-POINT CROSS bits and WITHOUT SHANK AND COLLAR

Drilling Length, Excl. of Length of Chuck, Inches	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE		Telegraph Name of Set	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE		Telegraph Name of Set	Diam. of Bit, Inches	Approx. Weight Per Steel, Lbs.	LIST PRICE		Telegraph Name of Set
			Per Single Steel	Per Set				Per Single Steel	Per Set				Per Single Steel	Per Set	
Standard 6-in. Run	Heavy 1-Inch Cruciform HA or MA HB or MB				Section 272 See Page 17	Heavy $1\frac{1}{8}$-Inch Cruciform HB or MB HC or MC				Section 274 See Page 17	Heavy $1\frac{1}{4}$-Inch Cruciform HC or MC				Section 307 See Page 17
6	$1\frac{3}{4}$	$2\frac{1}{4}$	$0.90		Volemilca	2	$3\frac{1}{2}$	$1.00		Volemimago	$2\frac{1}{4}$	$3\frac{1}{2}$	$1.05		Voleminhos
12	$1\frac{11}{16}$	$3\frac{3}{4}$	1.00	$1.90	Volemile	$1\frac{15}{16}$	$4\frac{3}{4}$	1.15	$2.15	Volemimeca	$2\frac{5}{16}$	$5\frac{1}{4}$	1.25	$2.30	Voleminí
18	$1\frac{7}{8}$	5	1.10	3.00	Volemilega	$1\frac{7}{8}$	$6\frac{1}{4}$	1.30	3 45	Volemiment	2	7	1.45	3.75	Voleminien
24	$1\frac{15}{16}$	$6\frac{1}{4}$	1.20	4.20	Volemilejo	$1\frac{13}{16}$	$7\frac{3}{4}$	1.45	4.90	Volemimes	$1\frac{15}{16}$	$8\frac{3}{4}$	1.60	5.35	Voleminina
30	$1\frac{1}{2}$	$7\frac{1}{2}$	1.30	5.50	Volemilete	$1\frac{3}{4}$	$9\frac{1}{4}$	1.60	6.50	Volemimian	$1\frac{7}{8}$	$10\frac{1}{4}$	1.75	7.10	Voleminize
36	$1\frac{7}{16}$	$8\frac{3}{4}$	1.40	6.90	Volemilhao	$1\frac{11}{16}$	11	1.75	8.25	Volemimila	$1\frac{13}{16}$	$12\frac{1}{4}$	1.90	9.00	Voleminoid
42	$1\frac{3}{8}$	10	1.50	8.40	Volemilhem	$1\frac{5}{8}$	$12\frac{1}{2}$	1.90	10.15	Volemimor	$1\frac{3}{4}$	14	2.05	11.05	Voleminola
48	$1\frac{5}{16}$	$11\frac{1}{4}$	1.60	10.00	Volemilham	$1\frac{9}{16}$	14	2 00	12.15	Volemimuda	$1\frac{11}{16}$	$15\frac{3}{4}$	2.20	13.25	Voleminoso
54	$1\frac{1}{4}$	$12\frac{1}{2}$	1.70	11.70	Volemilid	$1\frac{1}{2}$	$15\frac{3}{4}$	2.10	14.25	Volemimae	$1\frac{5}{8}$	$17\frac{1}{2}$	2.35	15.60	Volemio
60	$1\frac{3}{16}$	$13\frac{3}{4}$	1.80	13.50	Volemilimo	$1\frac{7}{16}$	$17\frac{1}{4}$	2.20	16.45	Volemimcor	$1\frac{9}{16}$	$19\frac{1}{4}$	2.50	18.10	Volemiogmo
Special 6-in. Run															
66	$1\frac{1}{4}$	15	1.90	15.40	Volemilire	$1\frac{3}{8}$	$18\frac{3}{4}$	2.30	18.75	Volemindad	$1\frac{7}{16}$	21	2.65	20.75	Volemiolam
72	$1\frac{5}{16}$	$16\frac{1}{4}$	2.00	17.40	Volemillai	$1\frac{5}{16}$	$20\frac{1}{4}$	2.40	21.15	Volemineam	$1\frac{7}{16}$	$22\frac{3}{4}$	2.80	23.55	Volemioli
Standard 12-in. Run															
12	$1\frac{1}{8}$	$3\frac{3}{4}$	1.00		Volemillez	$1\frac{15}{16}$	$4\frac{3}{4}$	1.15		Volemineio	$2\frac{1}{16}$	$5\frac{1}{4}$	1.25		Volemionar
24	$1\frac{5}{8}$	$6\frac{1}{2}$	1.20	2.20	Volemillis	$1\frac{13}{16}$	$7\frac{1}{8}$	1.45	2.60	Volemiiner	$1\frac{13}{16}$	$8\frac{3}{4}$	1.60	2.85	Volemionda
36	$1\frac{7}{16}$	$8\frac{3}{4}$	1.40	3.60	Volemillum	$1\frac{11}{16}$	11	1.75	4.35	Volemineta	$1\frac{13}{16}$	$12\frac{1}{4}$	1.90	4.75	Volemionem
48	$1\frac{5}{16}$	$11\frac{1}{4}$	1.60	5.20	Volemilogo	$1\frac{9}{16}$	14	2 00	6.35	Volemingai	$1\frac{11}{16}$	$15\frac{3}{4}$	2.20	6.95	Volemionne
60	$1\frac{3}{16}$	$12\frac{3}{4}$	1.80	7.00	Volemilos	$1\frac{7}{16}$	$17\frac{1}{8}$	2 20	8.55	Volemingo	$1\frac{9}{16}$	$19\frac{1}{4}$	2.50	9.45	Volemions
Special 12-in. Run															
72	$1\frac{1}{16}$	$16\frac{1}{4}$	2.00	9.00	Volemilyba	$1\frac{5}{16}$	$20\frac{1}{4}$	2.40	10.95	Volemingue	$1\frac{7}{16}$	$22\frac{3}{4}$	2.80	12.25	Volemiopea